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SUGAR INDUSTRY IN THE SYRIAN ARAB REPUBLIC[1/]

by

Abdallah Sallouta*

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* Deputy Minister, Ministry of Industry, Damascus

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INTRODUCTION

The sugar industry is one of the most important food processing industries in the Syrian Arab Republic and has been introduced into the Country only relatively recently, namely after World War II. Until then the domestic market relied entirely on imported sugar to meet consumption demands.

In 1946 the Sugar and Agricultural Products Industrialization Company was founded, which undertook the task of establishing the first sugar plant in Syria. Homs was chosen as plant site due to its excellent geographical position, to the fertility of its agricultural land and to availability of water for irrigation and industrial uses, besides the success shown by trials carried out to introduce sugar-beet cultivation there, where produced beet had a sweetness degree not below 15 per cent. Execution of the project began in November 1947 and was completed in April 1949.

The Company succeeded in getting over the difficulties that faced its project during early years of operation, but thanks to Government loans extended to it in 1951 and other backing measures taken by the Government, such as vesting in the Company the right to import raw sugar into the Country, the financial position of the Company was strengthened, thus enabling it to embark on the dissemination of sugar-beet cultivation by granting farmers technical assistance and other facilities which proved to constitute succesful incentives.

In view of the increasing home market demand for sugar and the expansion in the field of sugar-beet cultivation, not only in the Homs area but also in the southern region of the Country, the Syrian Company for Sugar Extraction and Refining, founded in 1959, established the second sugar plant in Syria, in Ayn, 24 km north of Damascus. The new plant was inaugurated in August 1960.

Since local consumption demand for this vital commodity kept up increasing and in the light of the agricultural policy of the Country which began to take shape after implementation of the El-Ghab land reclamation project, a third sugar plant was planned. The site was chosen in Jisr El-Shoghour, situated in the Ghab valley. Execution of the new project, belonging to the Sugar and Agricultural Products Industrialization Company, started in 1964 and was completed and entered into operation in 1968.

Machinery and equipment for all three plants were supplied by the Czechoslovak firm "Technoexport".

Each of the three plants was so designed as to be able to extract sugar from sugar-beet and to refine imported raw sugar. These are the two main raw materials used by the sugar plants, and since raw sugar is imported at world market prices, the other raw material produced locally, namely, sugar-beet, will be dealt with later on in some detail.

The nominal production capacity of these plants is as follows:

Plant	Sugar-beet processing (tons/day)	Raw-sugar refining (tons/day)
- El-Ghab	2000	300
- Homs	1200	300
- Adra	600	200
Total	3800	800

In early January 1965 both the Sugar and Agricultural Products Industrialization Company and the Syrian Company for Sugar Extraction and Refining were nationalized. By virtue of decree No. 268/66 issued by the Minister of Industry on 10 July 1966, these two companies merged into the newly created Syrian Company for Industrialization of Sugar and Agricultural Products, the capital of which is estimated at 75 million Syrian pounds.

Besides its main industrial activity, i.e. sugar production, the Company comprises a number of other industries, namely: vegetable oils, soap, alcohol, carbon dioxide and glucose, all of which are located nearby the Homs plant, and baker's yeast, located in Damascus.

Measures have been taken recently to cancel the above mentioned merger in such a way that:

- The Homs sugar plant, together with other industrial plants located nearby it and just referred to above, will form a single enterprise.

- The Adra sugar plant and the yeast factory will form another enterprise.

- The El-Ghab plant will form a third enterprise.

Implementation of such measures is under way at present.

I. RAW MATERIALS

A. Sugar-beet cultivation in the Syrian Arab Republic

Cultivation of sugar-beet, the main raw material in the sugar industry, was introduced into the Country for the first time in 1947, when the Sugar and Agricultural Products Industrialization Company concluded contracts for cultivation of sugar-beet covering only some tens of hectares, in order to test the suitability of cultivation of the new crop. Several years elapsed before cultivation of sugar-beet settled in the Country. This was achieved in the late 1950s. Until then no plans existed envisaging the need for such cultivation and future trends. Relevant agricultural policies defining the importance of this cultivation in the agricultural cycle and in the Country's economy were also lacking, despite the fact that sugar is regarded as one of the most important consumption commodities. So sugar-beet continued to rank as a secondary crop in comparison with others, such as cotton, for example.

In 1968 an autonomous organization should have been established to undertake the task of supervising all matters connected with sugar-beet cultivation and development. Nevertheless, it was decided in the same year that this task should be assigned to the Ministry of Agriculture and Agrarian Reform, while the role of the Ministry of Industry was defined to be industrialization of the sugar-beet crop. It was also decided that the agriculture department of the Sugar Company should be transferred to the Ministry of Agriculture and Agrarian Reform within a transition period of three years. This transfer was never put into effect and thus the Company remained responsible for agricultural matters dealing with the subject, besides its industrial tasks.

Since the late 1960s great interest was focused by the State on sugar-beet cultivation, especially that prospects for agricultural development projects in the country are quite ample. Land reclamation and canalization schemes in the Ghab region led to the availability of wide areas of irrigated land. Moreover, the Euphrates project, well under way at present, will provide for the irrigation of about 800 thousand hectares of land.

B. Measures to increase productivity of sugar-beet cultivation

In order to increase productivity and improve yields of sugar-beet cultivation, a new plan of operation was formulated and adopted. The plan is based on scientific grounds and bears in mind field conditions and capabilities of the Syrian farmer. It may be summarized as follows:

a. Contracting stage:

The technical control measures necessary to draft contracts with farmers were formulated. These dealt with a number of matters among which mention may be made of the following: agricultural cycle, methods of agriculture, suitable sowing time, use of herbicides and pesticides, splitting up of agricultural loans into

three stages linked with implementation of operations stipulated in the contract, provision of agricultural guidance to farmers, etc.

b. Follow-up of agricultural operations:

This stage covers the following:

1- Tests carried out on the main problems facing cultivation of sugar-beet in the field.

2- Instruction and guidance of farmers through direct contact with them.

c. Measures to stabilize, develop and expand crop cultivation:

These include the following:

1- A certain percentage of cultivable areas has been fixed for contracting in the light of quantity of water available for irrigation and with the aim of securing a suitable agricultural cycle, where sugar-beet is introduced as a main crop, bearing in mind the need of sugar plants for beet, for industrialization purposes. Such percentage has been fixed as follows:

i- 40-45% autumn sugar-beet

ii- 55-60% summer sugar-beet

2- Contracts may be concluded with any farmer, instead of being confined to previous farmers only. Collective contracting is encouraged.

3- Linking of monetary loans extended to farmers with agricultural operations actually carried out.

4- Linking of crop delivery with the sowing date and first irrigation date.

C. Development of sugar-beet cultivation

Regions of cultivation of sugar-beet are closely linked with sugar plant sites. Thus the main regions are as follows:

Plant site	Cultivation region	Soil characteristics	Average sweetness degree of crop
- Adra	Damascus	Chalky	15.5 %
- Homs	Homs	Red coloured	16.5 %
- El-Ghab	Hama and Idlib	Muddy	16.0 %

Table 1 shows development of sugar-beet cultivation in Syria from 1949 to 1973, and planned cultivation figures for 1974.

Table I: Development of Sugar-beet Cultivation in Syria

Year	Cultivated area (hectares)	Sugar-beet crop (tons)	Quantity of sugar extracted (tons)	Crop Yield (tons/hectare)	Percentage sugar extraction from sugar-beet %
(a) Homs plant area:					
1945	125	1353	...	10.84	.. ..
1950	345	3908	411	11.33	10.54
1951	147	2085	107	14.20	7.66
1952	1700	17564	2029	10.32	11.57
1953	4590	54060	6958	11.80	12.85
1954	4584	54115	7150	11.81	13.20
1955	2374	38480	4204	15.63	10.86
1956	2802	52704	6235	18.83	11.82
1957	3435	61970	6730	18.07	11.02
1958	1640	32632	3903	19.89	11.96
1959	3669	63_36	9030	17.21	14.24
1960	5644	53579	7279	17.39	11.48
1961	3467	39302	6477	17.08	10.98
1962	3138	63304	6083	20.27	9.85
1963	3335	70438	7737	21.11	11.01
1964	4867	121330	13164	24.93	10.84
1965	5800	110610	13266	19.05	12.00
1966	6761	134674	14873	19.91	11.04
1967	4970	100886	12466	20.21	12.37
1968	4000	64619	9723	21.00	11.56
1969	4005	106452	10159	27.08	9.35
1970	4204	105321	13042	25.06	12.37
1971	4100	110400	11900	27.3	10.78
1972	3900	88200	11900	23.0	13.47
1973	3200	63200	8427	19.7	13.31
1974*	4000	117000	14250	29.0	12.18

(*) Planned figures.

Year	Cultivated area (hectares)	Sugar-beet Crop (tons)	Quantity of Sugar extracted (tons)	Crop Yield (tons/hectare)	Percentage sugar extraction from sugar-beet %
(b) Adra plant area:					
1959	1351	23723	2535	17.55	10.68
1960	1479	33635	3671	22.81	10.90
1961	1396	26863	2999	19.25	11.17
1962	845	17439	1820	20.63	10.43
1963	811	16459	1603	20.30	9.73
1964	1895	59061	6963	29.06	10.81
1965	2100	60174	6304	28.65	10.38
1966	1815	54871	5661	30.08	10.36
1967	1650	51300	5077	31.21	9.87
1968	1900	46585	4881	24.80	10.48
1969	1733	55639	5203	32.10	9.37
1970	3128	59800	4938	27.97	8.31
1971	1500	50700	4800	33.2	9.47
1972	1700	51600	4700	30.8	9.11
1973	1600	45400	3556	28.0	7.83
1974 *	1700	51000	6227	30.0	12.20
(c) El-Ghab plant area:					
1967	685	6200	123	9.07	19.80
1968	1997	26000	3130	13.01	8.20
1969	1241	31220	4600	18.71	19.78
1970	2738	56557	9309	23.90	13.97
1971	3000	71100	7500	24.70	10.53
1972	4000	109100	6900	27.32	8.06
1973	2900	43900	4266	15.15	9.74
1974 *	4550	139600	19031	30.67	11.50

(*) Planned figures.

7. Quality , suitability and price of sugar-beet

The interest concentrated on sugar-beet cultivation and the care dedicated to it resulted in the production of a crop of reasonable quality and suitability for industrialization purposes.

The types of sugar-beet seeds allowed to be imported and thus used for cultivation are fixed annually by a decree issued by the Ministry of Agriculture and Agrarian Reform, in the light of research work carried out in this respect by the competent department of the said Ministry. Normally, import is restricted to those types characterized to give high crop yields and high sweetness percentage.

Thus for the 1973-1974 agricultural season, the types of sugar-beet seeds that may be imported are, according to decree No. 383/ula. issued by the said Ministry on 16 May 1973, the following:

a. Autumn sugar-beet:

	Name	Country of Origin
1-	Maribo Magna-poly	Denmark
2-	Maribo Ota-poly	"
3-	Klein A.A.	Western Germany
4-	Zwanissi	Holland
5-	Semirave	"
6-	Tonorave	"
7-	Mezano A.C. Diploid	Italy
8-	Khon R.S.A.	Holland

b. Summer sugar-beet:

	Name	Country of Origin
1-	Deuxpresse polyploid	France
2-	Zwan poly	Holland
3-	Polyfer E.	France
4-	Mezano Polyploid	Italy
5-	Plenta	Eastern Germany
6-	Trirave E.	Holland
7-	Polex polyploid	Belgium
8-	Klein polybeta	Western Germany
9-	Maribo Magna-poly	Denmark

Analytical tests are usually carried out on samples of the crop collected from areas differing in location and sowing date in order to estimate extent of ripeness. Sweetness percentage and ratio of the weight of roots to the weight of leaves are the two main factors borne in mind during analytical work. Theoretically speaking, it is possible to start harvesting the crop once the sweetness percentage reaches 14 %, but practically it is advisable to postpone it until the percentage reaches at least 16 per cent.

This figure of 16 per cent is taken as the standard sweetness degree on which pricing is based. Early this year, 1974, sugar-beet prices paid to farmers have been raised as follows:

a. For the autumn sugar-beet:

Former price	Present price
65 LS./ton	80 LS./ton

b. For the summer sugar-beet:

Former price	Present price
70 LS./ton	88 LS./ton

These prices are for sugar-beet of 16 per cent sweetness degree and are subject to variations depending on the actual sweetness of beet delivered to the plant, according to the following scale:

Sweetness degree	Autumn sugar-beet Price LS./ton	Summer sugar-beet Price L.S/ton	
10 %	65-7 = 58	57-7 = 50	
11 %	72-7 = 65	64-7 = 57	
12 %	77-5 = 72	69-5 = 64	
13 %	82-5 = 77	74-5 = 69	
14 %	85-3 = 82	77-3 = 74	
15 %	88-3 = 85	80-3 = 77	
16 %	Standard sweetness 88	80	basic price
17 %	88+3 = 91	80+3 = 83	
18 %	91+3 = 94	83+3 = 86	
19 %	94+5 = 99	86+5 = 91	
20 %	99+5 = 104	91+5 = 96	

7. Future trends in sugar-beet production:

Sugar-beet cultivation areas during the Third five-year Plan period 1971-1975 were expected to be as follows:

Region	Expected cultivation area (1971 - 1975) (hectare)	Average crop yield (ton / hectare)
- Homs plant region	30 000	24
- Adra plant region	8 500	30
- El-Ghab plant region	20 000	17

Comparison of these figures with actual data given in Table 1 shows that for both Homs and Adra there is fairly good agreement. In the El-Ghab region, however, cultivated areas fell below expectations by about 15 per cent, while yields were higher than expected by about 6 per cent.

Agricultural, soil and climatic conditions research has shown that there are good possibilities of increasing sugar-beet cultivated areas as follows:

- In Homs plant region : It is possible to double presently cultivated areas, to reach 8000 hectares, i.e. twice the Homs plant capacity.
- In Adra plant region : Cultivated areas may be increased three fold, but the Adra plant capacity is in line with presently cultivated areas.
- In El-Ghab plant region: It is possible to increase cultivated areas to 10 000 hectares and the El-Ghab plant can cope with the resulting increase in sugar-beet production.

However, it is possible to increase production of sugar-beet vertically, i.e., to increase crop yield by introduction of modern mechanized methods of agriculture, proper use of fertilizers, selection of most suitable seeds, etc., while keeping cultivated areas within the ranges expected for the years 1971 - 1975. Thus for the period 1976 - 1990 the following figures may be cited:

Region	Expected sugar-beet Cultivation area (1976-1980) (hectares)	Average expected crop-yield tons/hectare	Total crop tons 1976-1980	annual
- Homs	20 000	32	640 000	128 000
- Adra	8 500	38	323 000	64 500
- El-Ghab	20 000	32	640 000	128 000

This means that it will be possible to operate both Homs and Adra plants at full production capacity with respect to sugar-beet processing, while operation of the El-Ghab plant will be in the range of 64 per cent of the nominal capacity.

Nevertheless, for the next five-year plan period 1976 - 1980, sugar-beet cultivation is expected to spread widely in the Euphrates basin, where irrigation water is available and agricultural pilot tests have proved the success of sugar-beet cultivation. A new sugar plant will be built in Rakka, in the Euphrates basin, having a production capacity as follows:

- 3000 tons/day : sugar-beet processing
- 400 tons/day : raw-sugar refining

This implies that the amount of sugar-beet that will be needed by the new plant for processing will be in the range of 240 000 tons/year, on the assumption that the sugar-beet campaign in that area will last 80 days. It is expected that the new plant will be ready to start production by mid 1979.

F. Promotion of sugar-beet cultivation

Promotion and encouragement of sugar-beet cultivation in the Country may be accomplished through a number of measures, namely:

a. Paying special attention to scientific agricultural research.

b. Concentrating efforts on increasing cultivated areas.

c. Increasing productivity vertically by all available means. This will, in turn, lower production costs.

d. Reconsideration of the agricultural production tax which is levied on sugar-beet and amounts to 9.5 per cent of its value, and is paid by the Syrian Company for Industrialization of Sugar and Agricultural products.

e. Granting encouraging incentives to develop and settle sugar-beet cultivation in new areas.

II. SUGAR PRODUCTION

A. Production capacity of existing sugar plants

As mentioned earlier, there are three sugar plants in the Syrian Arab Republic, namely, Homs, Adra and El-Ghab, all of which are capable of producing refined sugar from sugar-beet processing or from raw-sugar refining.

The nominal production capacity of the three plants is 3800 tons/day of sugar-beet (processing) or 800 tons/day of raw-sugar (refining). This means that during the sugar-beet industrialization campaign, which extends for about 100 days, the plants can process 380 000 tons of sugar-beet, thus giving 45 600 tons of sugar, taking the average yield of sugar from sugar-beet as 12 per cent.

Bearing in mind that the maintenance period of sugar plants lasts no less than 125 days, there remain 140 days per year available for raw-sugar refining, i.e.,

$$365 - (100 + 125) = 140 \text{ days}$$

and since the refining capacity of the three plants is 800 tons/day, this means that the amount of sugar that can be thus produced is:

$$140 \times 800 = 112\,000 \text{ tons/year}$$

Hence the nominal annual production capacity of the three plants is:

$$45600 + 112000 = 157600 \text{ tons of sugar/year}$$

distributed as follows:

Plant location	Sugar production		
	From sugar-beet processing	From raw-sugar refining	Total
	tons/year	tons/year	tons/year
- El-Ghab	24000	42000	66000
- Homs	14400	42000	56400
- Adra	7200	28000	35200
	45600	112000	157600

B. Actual situation of sugar plants and problems facing them:

The three plants, despite the difference in their machinery and equipment, have the following features in common:

- Each plant in its present situation can produce refined sugar the specifications of which comply with world standards.

- Each plant is capable of reaching the nominal production capacity - with respect to raw sugar refining - and may in fact exceed it when treating raw-sugar of good specifications.

- These plants failed to reach their nominal capacities during the sugar-beet processing campaign, for reasons peculiar to each plant. These reasons are summarized in the following paragraphs.

a- Homs plant

The Homs sugar plant is considered to be in good technical and production conditions, whether during sugar-beet industrialization campaigns or during raw-sugar refining cycles. Both production and yield run almost normally.

Originally, the design capacity of the plant was 600 tons/day of sugar-beet. In 1963 an expansion scheme was implemented and some modifications introduced to installed machinery and equipment, most important of which was the replacement of the classical diffusion system, of batchwise operation, by a vertical continuous diffusion one. This led to increasing capacity of the plant to 1200 tons/day of sugar-beet containing 16 per cent of sucrose. Nevertheless, the actual consumption figures during the past few years were below that level and they averaged 1000 tons of sugar-beet per day, i.e., 83.4 per cent of the nominal capacity.

The present Third Five-year Plan for Economic and Social Development 1971 - 1975, has provided for the development of the Homs sugar plant through substitution of relatively old pieces of machinery and equipment by new and modern ones, in order to keep pace with recent technical developments in this field. Implementation of this development plan is well under way, and it is expected that its completion will lead to improving productivity and increasing efficiency, besides improving working conditions in the plant and saving labour.

The Homs sugar plant was one of a few industrial establishments in the Orontes basin found responsible for pollution of the waters of the said river. In view of the potential dangers of such pollution, quick action has been taken by the Government since mid 1971 in order to find the necessary solutions of the problem. Anti-pollution measures were thus implemented in the Homs sugar plant and results obtained were quite satisfactory.

Table 2 shows development of sugar production in the Homs plant during the period 1965 - 1973, as well as planned production figures for 1974.

Table 2. Sugar production in the Homs plant

Year	Sugar produced						By - products	
	Fom sugar-beet		From raw-sugar		Total		Molasses (tons)	Beet-pulp (tons)
	Quantity (tons	Percentage with respect to plant capacity %	Quantity (tons)	Percentage with respect to plant capacity %	Quantity (tons)	Percentage with respect to plant capacity %		
1965	13166	91.4	48729	116.0	61895	109.6	8068	4460
1966	14873	103.1	49692	118.3	64565	114.6	9103	5046
1967	12466	86.5	34530	82.2	46996	83.4	6370	3380
1968	9723	67.5	31095	74.1	40818	72.5	6619	3605
1969	10159	73.5	39009	92,8	49168	87.2	6843	4073
1970	13042	90.6	40680	97.0	53722	95.4	8275	4918
1971	11900	82.6	44900	106,9	56800	100.8	8158	5028
1972	11900	82.6	49024	116.8	60924	108.0	8498	4920
1973	8427	58.5	59044	140.7	67471	119.5	6142	3617
1974*	14250	98.9	44600	106.2	58850	104.3	8085	5700

(*) Planned figures.

b- Adra plant:

Despite the fact that the Adra plant was constructed ten years after the Homs plant, a period during which important developments were introduced to the sugar industry in connection with processing methods, machinery and equipment used, the Adra plant was established using classical machinery and equipment, some of which was already old fashioned, especially the diffusion section which was of the batch type, and up to date is still in operation and has not yet been replaced by a continuous one, while in the Homs plant such replacement was carried out in 1963.

Moreover, the plant site which cannot be regarded as a suitable one to be chosen for such an industry, has created a number of difficulties, most important of which are the following:

- Scarcity of water coupled with its relatively high hardness, which leads to scale depositions particularly in the hot water tubes and pipes, and thus to plant shut-downs every now and then for scale removal.

- Problems connected with transport of labour to and from the plant and the time needed for this purpose.

- It is not so easy for the plant to avail itself of the services of mechanical workshops located in Damascus to perform work which cannot be done at the plant workshop itself, because of the distance of the plant from town.

And so it is evident that water supply is the most serious problem facing the Adra plant, which relies on underground water present at depths ranging between 60 and 100 metres. Underground water sources in the plant area have become poorer and poorer, mainly because of low rainfall in the past few years and the establishment of farms near the plant which require fairly large amounts of underground water.

The subject of water supply and consumption at the Adra plant was tackled by the experts team sent by the Industrial Development Centre for Arab States (IDCAS) in early 1971. The team recommended measures for improvement of water consumption in the plant aiming at reducing the minimum plant requirements of water by about 50 per cent. It also submitted definite proposals for dealing with the deposition situation in the water-wells. Implementation of such proposals has recently been started.

Table 3 shows development of sugar production in the Adra plant during the period 1965 - 1973, as well as planned production figures for 1974.

Table 3: Sugar Production in the Adra Plant

Year	Sugar produced						By - products	
	From sugar-beet		From raw-sugar refining		Total			
	Quantity (tons)	Percentage with respect to plant capacity %	Quantity (tons)	Percentage with respect to plant capacity %	Quantity	Percentage with respect to plant capacity %	Molasses (tons)	Beet-pulp (tons)
1965	6304	87.7	26597	95.0	32901	93.5	6440	2998
1966	5661	78.7	20836	74.5	26497	75.4	5795	2699
1967	5077	70.5	19212	68.6	24289	69.1	4462	2194
1968	4881	67.9	16285	58.0	21166	60.1	3925	2484
1969	5202	72.5	22037	78.8	27239	77.5	3749	2193
1970	4938	68.6	16068	57.5	21006	59.7	3663	2315
1971	4800	66.7	19100	68.2	23900	67.9	4569	2329
1972	4700	65.3	24344	86.9	29034	82.5	4841	2447
1973	3536	49.4	25377	90.5	28913	82.1	4998	1881
1974*	6227	86.5	27180	97.0	33407	95.0	4703	2707

(*) Planned figures

c- Bl-Ghab plant:

Machinery and equipment in the Bl-Ghab plant are, in general, in good conditions. Thus the plant has been able to attain the nominal production capacity level in the refining section, i.e., 300 tons of raw-sugar per day, while in the sugar-beet processing section it has only been possible to reach 50 per cent of the nominal capacity, ie., 200 x 0.5 = 1000 tons of sugar-beet per day, because of the lack of uniformity in the capacities of the various component units of this section, besides the shortage of skills and well-trained labour, due to absence of employment incentives.

The main technical features that differentiate production lines in the Bl-Ghab plant from the other two plants, namely Homs and Adra, are the following:

- Sugar-beet unloading in the Bl-Ghab plant from lorries to the pits and conveying from the pits to the inside of the plant is carried out mechanically and at a speedier rate.

- Lime addition to the juice and saturation with carbon dioxide is performed continuously, while in the other two plants it is batchwise .

- Filtration of the juice and the syrup is carried out in candle-type filters, while the other two plants use filter presses.

- The ion exchange method is employed in the Bl-Ghab plant to remove colour from the juice, while the Homs and Adra plants use active charcoal for the same purpose.

Table 4 shows development of sugar production in the Bl-Ghab plant during the period 1967 - 1973, as well as planned production figures for 1974.

Table 4 : Sugar Production in the El-Ghab Plant

Year	Sugar produced						By - products	
	From sugar-beet		From raw-sugar refining		Total		Molasses (tons)	Beet-pulp (tons)
	Quantity (tons)	Percentage with respect to plant capacity %	Quantity (tons)	Percentage with respect to plant capacity %	Quantity (tons)	Percentage with respect to plant capacity %		
1967	123	0.5	1780	4.2	1903	2.9	....	....
1968	2130	8.9	19337	46.0	21467	32.6	2049	1018
1969	4600	19.2	32513	77.4	37113	56.2	4158	2754
1970	9309	39.8	39978	95.3	49287	74.6	6327	4660
1971	7500	31.2	42200	100.5	49700	75.4	7133	4206
1972	8800	36.6	38391	91.5	47191	71.5	8859	5050
1973	4625	19.3	40879	97.5	45504	69.1	4339	2018
1974*	16031	66.8	38148	90.8	54179	82.1	8452	7695

(*) Planned figures

C. Total sugar production:

Table 5 shows total amounts of sugar produced in Syria during the period 1965 - 1973 as well as planned production figures for 1974:

Table 5: Sugar production in the Syrian Arab Republic

Year	Sugar production (tons)			By-products (tons)	
	From sugar-beet	From raw-sugar	Total	Molasses	Beet-pulp
1965	19470	75326	94796		
1966	20534	70528	91062	14898	7745
1967	17666	55522	73188	10832	5574
1968	16734	66717	83451	12593	7107
1969	19961	93559	113520	14750	9020
1970	27289	96726	124015	18265	11893
1971	24200	106200	130400	19860	11563
1972	25400	111759	137159	22198	12417
1973	16608	125280	141888	15479	7516
1974*	36508	109928	146436	21240	16102

It should be pointed out that sugar production is linked with actual market demand, particularly to meet home consumption needs. Sugar exports are practically nil due, not only to high production costs and duties and taxes levied, but also because since the late 1960s local production failed to meet consumption demands, with the result that refined sugar had to be imported to make up for the deficit.

D. By-products:

Sugar production from sugar-beet gives two main by-products, namely molasses and beet-pulp, while from raw-sugar refining the only by-product is molasses. Table 5 gives the amounts of by-products resulting from sugar production during the period 1965 - 1973, as well as planned figures for 1974.

(*) Planned figures.

a- Molasses:

This by-product may be used as a raw material for a number of industries based on fermentation processes, such as: baker's yeast, alcohol, citric acid, etc, as well as a component of cattle feed.

At present about 4.0-4.5 thousand tons of molasses produced are used in the production of baker's yeast. Yeast production reached 1423 tons in 1972 and 1662 tons in 1973. Molasses is sold to the yeast plant at 80 Syrian Pounds per ton at the basic polarization degree of 40 - 45.

Alcohol is also produced locally from molasses. Production reached 1830 tons in 1972 and 1890 tons in 1973.

The remainder of molasses is available for export, thus in 1972 12324 tons were exported while in 1973 the export figure was 4000 tons. Export prices are those prevailing in world markets.

The Third Five-Year Plan 1971 - 1975 includes two projects which will rely on molasses as raw material. These are:

1- A project for a new baker's yeast plant, having a production capacity of 10 tons yeast/day; the relevant contract has already been signed with a French company. Total costs are estimated at 10 - 11 million Syrian pounds.

2- A project for the production of citric acid, having a production capacity of 1800 - 2800 tons/year. Costs are estimated at 22.5 million Syrian pounds.

b- Beet-pulp:

Beet-pulp resulting from sugar-beet processing is dried and sold as cattle feed. The dried pulp is packed in jute bags and sold to farmers at 110 Syrian pounds per ton. All beet-pulp resulting from the sugar industry is sold locally.

III. SUGAR DISTRIBUTION, PRICING AND CONSUMPTION

A. Distribution and pricing of sugar:

Sugar distribution in Syria is undertaken by the General Consumption Institution, a Government organization in charge of distributing a number of consumer goods.

The buying price of sugar from producing plants charged to the Institution as well as the selling prices to consumers are determined by decrees issued by the Ministry of Supply and Home Trade.

Thus according to decree No. 636 of 27 May 1972 issued by the said Ministry, two price levels for sugar retail trade have been established, in accordance with Government policy of stabilizing domestic prices of basic consumer goods and avoid burdening the consumer with price increases resulting from rises in world prices. These prices are:

a. 0.85 Syrian pounds per kg of sugar sold against "supply coupons", by which 2 kg per person were allowed monthly. This quantity was later reduced to 1.5 kg per person by virtue of decree No. 303 of 21 March 1973, issued by the same Ministry.

b. 1.45 Syrian pounds per kg of "free sugar" sold without coupons.

Selling price of sugar ex-works to the Institution was determined by decree No. 541 of 17 May, 1973 issued by the Ministry of Supply and Home Trade to be 810 Syrian pounds per ton. The same decree fixed the distribution commission allowed to the Institution when selling to retail traders as follows:

a. 1.0 Syrian piastre per kg of "supply coupon" sugar.

b. 2.5 Syrian piastres per kg of "free sugar".

The overall deficit resulting from sugar distribution and marketing is covered by the Government treasury.

B. Domestic sugar consumption:

Sugar produced in the three plants is delivered to the General Consumption Institution, in charge of distribution of sugar in the domestic market, as mentioned earlier, according to the terms of the contract signed by the two parties concerned, namely, the Sugar Company and the Institution.

The said Institution is also entrusted with the distribution of imported refined sugar. Actual importation is carried out by the General Foreign Trade Organization for Chemical and Food Products.

Sugar sales at the Consumption Institution may be taken to represent the actual domestic consumption of this commodity. Table 6 shows the development of total sugar production, importation and sales, i.e. consumption, and per capita consumption during the period 1967 - 1973.

Table 6: Total sugar production, importation and sales, i.e. consumption, and per capita consumption

Year	Total sugar			Population	Annual per-capita consumption
	production (tons)	imports (tons)	sales, i.e. consumption (tons)	(million)	(kg)
1967	73188	14000	85203	5.799	14.7
1968	83451	3874	94976	6.244	15.2
1969	113520	-	113466	6.471	17.5
1970	124015	10000	130914	6.796	19.3
1971	130400	66902	170191	7.073	24.1
1972	137159	24386	175341	7.306	24.0
1973	141888	43786	178000	7.547	23.6

Increase in annual consumption of sugar is due to: increase in population, improvement in annual income and in living standards, stabilization of prices in the domestic market despite the sharp rise in world prices and the relatively low price level of sugar as compared with prices in the neighbouring countries.

C. Future trends in sugar consumption in the domestic market

From figures given in Table 6 it is possible to estimate future trends in sugar consumption up to 1980. Thus 1973 will be taken as the base year. During the whole of 1973, the two-price sugar system, namely "supply-coupon sugar" and "free sugar", introduced in May 1972, has been in force, and therefore, consumption figures for 1973 are quite reliable and can be taken to represent actual consumption. The two-price system is described in detail later, under "Distribution and pricing of sugar".

Consumption figures for 1971 and 1972 are larger than expected, and because domestic prices were then much lower than those in neighbouring countries, large amounts of sugar found their way across the borders.

The average annual growth in domestic sugar consumption may be estimated at 14 - 15 thousand tons. Hence projection of sugar demand for the period 1974 - 1980 will give the following results:

Year	Estimated demand (tons)
1974	193 000
1975	208 000
1976	223 000
1977	238 000
1978	253 000
1979	268 000
1980	283 000

It is evident from Table 6 that existing sugar plants, the maximum production capacity of which is 157600 tons/year, failed since the late 1960s to meet domestic consumption demands, and local production had to be supplemented by imports of refined sugar. This leads to consider seriously the creation of new production capacities that would keep pace with projected demand.

IV. DEVELOPMENT PLANS IN THE SUGAR INDUSTRY

The present Third Five-Year Plan 1971 - 1975 has allocated 6.1 million Syrian pounds to the completion of the development scheme undertaken by the Syrian Company for Industrialization of Sugar and Agricultural products. According to this scheme which aims at removal of bottlenecks , replacement of some parts of machinery and equipment which is either worn out or has become obsolete and improvement of production control side, it is expected to improve plant productivity, ensure correct proportions between the various sections of the production lines and reduce the time required for maintenance and repair. Actual expenditure during the first three years of the plan reached 2.63 million Syrian pounds, i.e. about 43 per cent of the planned figure.

A project for establishment of a new sugar plant in the Rakka area has recently been added to the Third Five-Year Plan. The production capacity of the new plant will be: 3000 tons/day: sugar-beet processing
and : 400 tons/day: raw-sugar refining.

The amount of sugar to be produced annually will thus be: 28800 tons from sugar-beet, assuming that the sugar-beet campaign will last 80 days, plus 64000 tons from raw-sugar refining, i.e. 92800 tons.

The costs of the project are estimated at 75 million Syrian pounds.

In March 1974, a protocol was signed with the Czechoslovak firm Techno-export, which supplied machinery and equipment of the three existing sugar plants, to provide assistance in implementing the project. In principle, delivery of machinery and equipment for the new plant could start in 1977, and production could begin in June 1979, provided that the necessary contract is finalized by mid 1975.

On completion of this project the production capacity of the sugar industry in the Country will reach 250400 tons of sugar per year.

Decision to locate the new project in Rakka, in the Euphrates basin, was taken in the light of the very promising results given by agricultural pilot-scale tests carried out by the Ministry of Agriculture and Agrarian Reform on sugar-beet cultivation in the area, in addition to the availability of water supply for irrigation and industrial purposes.

According to such tests, crop-yield is expected to reach 55 tons of sugar-beet of 16 per cent sugar content per hectare, a figure which largely exceeds crop-yields in presently cultivated areas, given in Table 1.

The new plant is intended to meet consumption demands in the northern and eastern regions of the Country.

V. COST STRUCTURE

It is possible to give the cost structure related to the following operations, based on data applicable during 1973.

- Sugar-beet cultivation in the Damascus, Homs and El-Ghab areas (Table 7)
- Sugar production from sugar-beet in the Adra (Damascus), Homs and El-Ghab plants (Table 8)
- Sugar production from raw-sugar refining in the above mentioned plants (Table 9).

A. Cost structure of sugar-beet cultivation in the Damascus, Homs and El-Ghab areas:

It is possible to give a detailed cost structure of sugar-beet cultivation as shown in Table 7.

Table 7: Cost structure of sugar-beet cultivation

(1 9 7 3)

Cost element	Damascus		Homs and El-Ghab	
	Summer type	Autumn type	Summer type	Autumn type
	LS/ hectare			
- Ploughing and land preparation	130	There is no Autumn cultivation in the Damascus region	220	220
- Sowing	70		80	80
- Thinning	300		300	300
- Fertilizer distribution	20		20	20
- Herbicide and pesticide distribution	20		20	20
- Irrigation	-		100	100
- Harvesting and cutting off tops	250		280	280
- Transport	170		280	280
- Miscellaneous	20		20	20
- Fertilizer costs	280		280	280
- Herbicides and pesticides	60		60	60
- Seed costs	60		60	60
- Expenses peculiar to summer beet-root	-		100	-
Subtotal	1380		1820	1720
- Capital interest	26		47	37
- Land rent	600		450	450
Total costs	2006		2317	2207
- Cost per ton on the basis of:				
a- 30 tons/hectare crop yield:	66.9		77.2	73.6
b- 35 tons/hectare crop yield:	57.3		66.2	63.0

B. Cost structure of sugar production from sugar-beet in existing plants:

Detailed cost structure of sugar production from sugar-beet is shown in Table 8.

Table 8: Cost structure of sugar-production from sugar-beet in existing plants:

(1 9 7 3)

Cost element	Homs plant	Adra plant	El-Ghab plant	Average cost
	LS/ton	LS/ton	LS/ton	LS/ton
- Raw-materials *	639.60	756.01	677.52	675.24
- Packing materials	22.50	22.50	22.50	22.50
- Chemicals and auxiliary materials	42.34	66.00 (including depreciation)	42.34	46.99
- Wages	69.00	142.00	135.00	105.52
- Overhead charges	92.55	73.26	92.55	88.75
- Depreciation	24.07	(Included with chemicals)	411.16	154.59
- Administrative and financial charges	28.37	27.70	21.49	25.91
- Sales and distribution charges	7.20	4.45	2.76	5.16
- Sugar tax	150.00	150.00	150.00	150.00
Subtotal	1075.63	1243.02	1555.32	1270.20
- Capital interest	75.29	87.01	108.87	88.91
Total cost	1150.92	1330.03	1664.19	1359.11
- Less value of by-products	67.20	79.80	67.20	69.67
Net total cost	1083.72	1250.23	1596.99	1289.44

(*) Cost of raw materials was estimated on the basis of the average price of sugar-beet paid in 1973, i.e. 70 LS/ton as well as on the sugar yield from sugar-beet which was 12.5% in the Homs and El-Ghab plants and 10.5% in the Adra plant.

C. Cost structure of sugar production from raw-sugar refining in existing plants.

Detailed cost structure of sugar production from raw-sugar refining is given in Table 9.

Table 9. Cost structure of sugar production from raw-sugar refining in existing plants.

(1 9 7 3)

Cost element	Homs plant	Adra plant	El-Ghab	Average cost
	LS/ton			
- Raw materials *	1024.60	1031.23	1028.31	1027.33
- Packing materials	22.50	22.50	22.50	22.50
- Chemicals and auxiliary materials	15.57	66.00 (Including depreciation)	16.00	24.73
- Wages	24.12	40.80	9.82	21.55
- Overhead charges	49.50	73.26	49.50	53.71
- Depreciation	1.79	(Included with chemicals)	58.41	23.89
- Administrative and financial charges	11.90	27.70	3.91	13.59
- Sales and distribution charges	7.20	4.45	2.76	4.96
- Sugar tax	150.00	150.00	150.00	150.00
Subtotal	1307.18	1415.94	1346.21	1342.10
- Capital interest (at 7% rate)	91.50	99.11	94.23	93.94
Total cost	1398.68	1515.05	1440.44	1436.04
- Less value of by-products	2.90	2.90	2.90	2.90
Net total cost	1395.78	1512.15	1437.54	1433.14

(*) Cost of raw materials was estimated on the basis of the average price per ton of raw sugar C and F Latakia in 1973, i.e. 796.54 LS/ton.

D. Comparative sugar production costs in existing plants.

Tables 8 and 9 show that in 1973 sugar production costs from raw-sugar refining in the Homs and Adra plants were higher than those corresponding to production from sugar-beet. In the El-Ghab plant, however, it was the other way round.

This may be explained by the fact that:

a. World prices of raw-sugar continued to show a sharp rise during that year.

b. The Ghab plant worked during the 1973 sugar-beet season at only 19.3 per cent its nominal capacity, thus leading to increased production costs above those corresponding to raw-sugar refining.

In previous years, however, sugar production costs from raw sugar refining used to be lower than those related to production from sugar-beet processing, with exception of the year 1964, when raw-sugar prices underwent a great increase in world markets. This is evident from figures given in Table 10 which shows comparative sugar production costs in the three existing plants for a number of years.

Table 10: Comparative sugar production costs in existing plants (Syrian pounds per ton)

A- From sugar-beet processing:

	1964	1968	1969	1970	1973
- Homs plant	934.79	1171.40	1201.80	1058.32	1083.72
- Adra "	n.a.	1212.20	1368.24	n.a.	1250.23
- El-Ghab "	-	n.a.	1558.08	n.a.	1596.99

B- From raw-sugar refining:

	1964	1968	1969	1970	1973
- Homs plant	1153.17	739.00	794.90	859.00	1395.78
- Adra "	n.a.	806.40	811.49	n.a.	1512
- El-Ghab "	-	n.a.	893.71	n.a.	1437.54

It is evident from Table 10 that sugar production costs, whether from sugar-beet processing or from raw-sugar refining, in the Homs plant are lower than those in the other two plants. Detailed cost structures given in Tables 8 and 9 give the relevant explanation.

The average sugar production cost from sugar beet processing was in 1973, according to Table 8, 1289.44 Syrian pounds per ton, while that corresponding to raw-sugar refining was 1433.14 Syrian pounds per ton*, i.e. the difference between the two is 143.70 Syrian pounds. This may constitute a strong argument in favour of sugar production from sugar-beet, should world prices of raw-sugar remain in the high levels reached. Nevertheless it should be pointed out that the cost of raw materials for sugar production from sugar-beet was estimated on the basis of the average price paid for sugar-beet in 1973, namely 70 Syrian pounds per ton. However, since sugar-beet prices have been increased since early 1974, as previously mentioned and if on the average the new price is taken as 85 Syrian pounds per ton, the cost of raw materials as well as the average cost of sugar produced will increase by about 135 Syrian pounds per ton, thus bringing sugar production costs from sugar-beet and from raw-sugar to almost the same level.

(*) See Table 9.

VI. CONCLUSIONS AND RECOMMENDATIONS

It is evident from previous chapters that the sugar industry is well established in the Syrian Arab Republic. There are three existing plants: Homs, Adra and El-Ghab, the last one being the most advanced technologically. All of them are capable of producing sugar from sugar-beet processing or from raw-sugar refining.

Cultivation of sugar-beet locally was introduced in the late 1940s and proved to be quite successful, and although crop yield per hectare kept increasing until it reached about 30 tons, there are still ample possibilities of increasing it by making proper use of available means of vertical expansion in agriculture.

All three sugar plants are so equipped as to be able to give a product that will comply with world standard specifications. While plants have been capable of reaching nominal capacity with respect to sugar production from raw-sugar refining and exceed it in some instances, they failed to attain nominal capacity during sugar-beet processing cycles. Development schemes are well under way to improve productivity and efficiency of the plants and provide solutions to a number of technical problems facing them.

Local sugar production, at present, does not meet consumption demands. This has been the case since the late 1960s. Raw sugar is imported to cover the deficit.

A new sugar plant project has been added to the Third Five-Year Plan 1971 - 1975, to meet consumption demand in the northern and eastern regions of the country. The new plant is expected to be ready to start production in mid 1979. Total nominal production capacity in the country will then become 250 400 tons of sugar per year, while projected consumption demand is estimated to reach 268 000 tons in 1979.

Analysis of cost structure of sugar production from sugar-beet shows that cost of raw-materials constitutes the main cost element, representing on the average about 52.4 per cent of the total costs. Cost of raw materials includes agricultural production tax, which reaches about 46 Syrian pounds per ton of sugar. Sugar tax imposed on sugar represent 11.6 per cent of the total costs of beet-sugar and 10.4 per cent of the total cost of sugar from refining. This leads to think seriously about the need to revise the cost structure of the product to find out possible means of reduction in cost elements, particularly those just mentioned.

Finally, the following main proposals may be put forward with a view to promote development of the sugar industry in Syria and get over the difficulties facing it.

a. Efforts should be concentrated to: continue extension of support to sugar-beet cultivation, improve crop yield and increase cultivated areas. Particular attention should be

paid to agricultural research. Suitable incentives should be granted to develop and settle sugar-beet cultivation in new areas. United Nations technical assistance could be most useful in this respect.

b. Taxes and duties levied on raw-materials, namely, sugar-beet and raw-sugar, as well as on the finished product, should be subjected to overall revision with the aim of determining their effect on existing and planned sugar plants and enabling proper performance evaluation in industrial establishments.

c. The present accounting system in the plants was not formulated with a view to determine the actual cost structure of sugar from beet processing or from raw-sugar refining. There is thus a pressing need for an industrial accounting system which would furnish a very useful tool for control and planning purposes.

d. Each production cycle in the plants should be subjected to performance evaluation, so as to spot out any weak points or handicaps, and find out relevant solutions to prevent their recurrence. This will ensure better plant productivity and improved efficiency.

e. Cost structures in the various sugar plants should be the subject of careful and detailed study and must be based on data as accurate as possible, so as to differentiate between fixed and variable cost elements, and try to find out suitable means of introducing adjustments to the latter if deemed necessary.

f. Suitable employment incentives should be introduced so as to attract qualified technical and skilled personnel to work in the sugar industry, which suffers from an acute shortage of them.

g. Experience of personnel employed should be improved through in-plant training courses, whether abroad or locally. Services of sugar industry experts could be most useful in this respect. This is, in fact, one of the fields where United Nations technical assistance could be successfully extended to the local sugar industry.

h. The necessary time required for proper maintenance of the plant must actually be dedicated to this purpose, so as to ensure keeping the plants in good working conditions, avoid mishaps and minimize stoppages during production cycles.

i. Plans should be formulated and the necessary steps be taken to make full use of idle capacities in existing sugar plants .

Implementation of development and modernization schemes in this industry should be carried out without delay.

j. A long-range integrated agro-industrial plan, say for 10 - 15 years, for the development and expansion of the local sugar industry should be formulated, taking into account relevant agricultural, economic and strategic factors.